Basic Hydrology & Watershed Plan Implementation

Connecting the Pieces

Region 10 Tribal NPS Workshop
Olympia, WA
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Discussion Overview

Points to look for …

- Linkage to Implementation
  - *Practical approaches*
  - *Learning experience & examples*
- Review of Key Issues
  - *Adaptive management*
  - *Benchmarks*
  - *Monitoring*
- Questions & Feedback

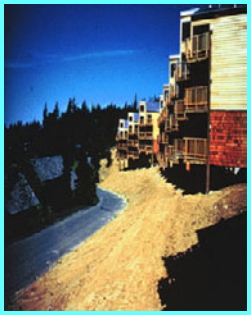
Watershed Plan Development

Problem Solving Framework

- Practical approach using key questions …
  - *WHY the concern*
  - *WHAT reductions are needed*
  - *WHERE are the sources*
  - *WHO needs to be involved*
  - *WHEN will actions occur*

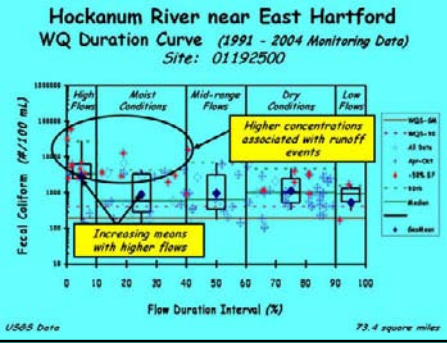
WHERE are the Sources

Hazard / Delivery



WHERE are the Sources

Prioritizing Assessment Efforts



WHERE are the Sources

Prioritizing Assessment Efforts

★ **Focus:** ***Source Areas & Delivery Mechanisms***

EXAMPLE		Duration Curve Zone				
	Contributing Source Area	High	Moist	Mid-Range	Dry	Low
	Point source				M	H
	Septics & Illicit Connections	M	M-H	H	H	H
	Riparian areas		H	H	M	
	Stormwater: Impervious Surfaces	H	H	H	M	
	Construction Site Runoff	H	H	M	M	
	CSO's	H	H	H		
	Bank erosion	H	M			

Note: *Potential relative importance of source area to contribute loads under given hydrologic condition (H: High; M: Medium; L: Low)*

WHO Needs to be Involved

Partnerships

- Treatment

WHO Needs to be Involved

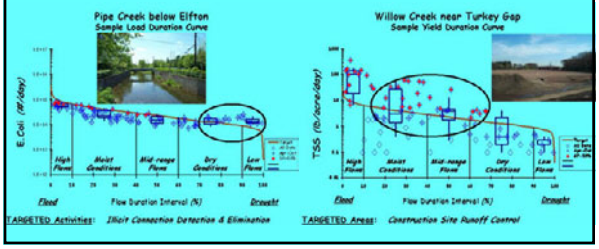
Partnerships

- Restoration / Protection

WHO Needs to be Involved

Developing Solutions

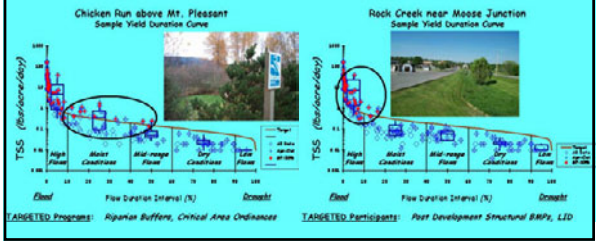
- Connect WQ concerns to potential programs …
  - √ *Watershed Condition -- Hydrologic*



WHO Needs to be Involved

Developing Solutions

- Connect WQ concerns to potential areas …
  - *Contributing Areas*



Lower Sangamon

Watershed Planning Effort

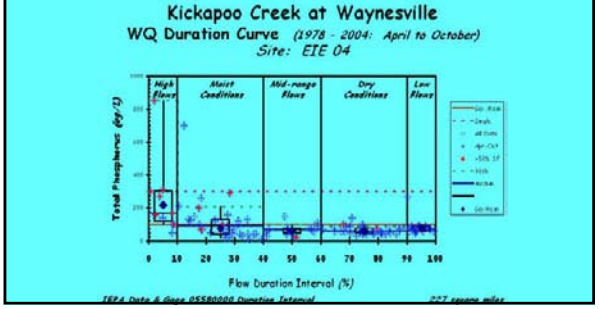
Salt Creek near Rowell, IL 8/11/2005

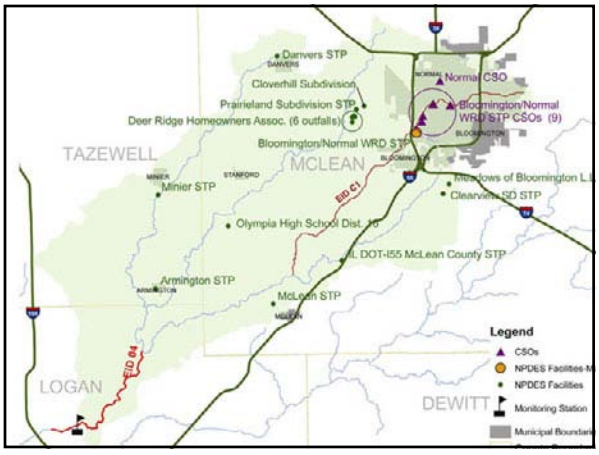
Kickapoo Creek near Waynesville, IL 8/11/2005

Connecting the Pieces

Developing Solutions

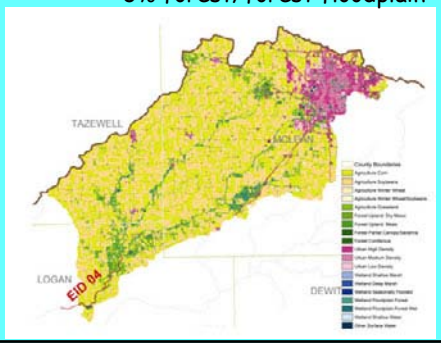
★ **Nutrient Management -- *Phosphorus***





Sugar Creek *(EID 04) -- 10 miles*

- **Land use** - 87% agriculture, 10% urban, 3% forest/forest floodplain



Sugar Creek trib at I-55 Rest Area, IL 8/11/2004

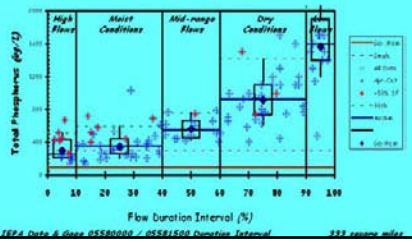
Sugar Creek near Hartsburg, IL 8/11/2005

Connecting the Pieces

Developing Solutions

- Nutrient Management -- *Phosphorus*

Sugar Creek near Hartsburg
WQ Duration Curve (1978 - 2004: April to October)
Site: EID 04

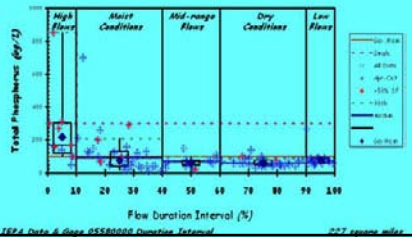


Connecting the Pieces

Developing Solutions

- Nutrient Management -- *Phosphorus*

Kickapoo Creek at Waynesville
WQ Duration Curve (1978 - 2004: April to October)
Site: EIE 04



Connecting the Pieces

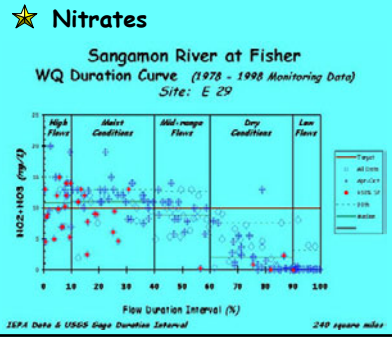
Developing Solutions

- Convert WQ Data to INFORMATION
  - ✓ *Prioritizing Areas of Concern*
  - ✓ *Connecting the Pieces*
  - ✓ *Implementation Focus*

Connecting the Pieces

Developing Solutions

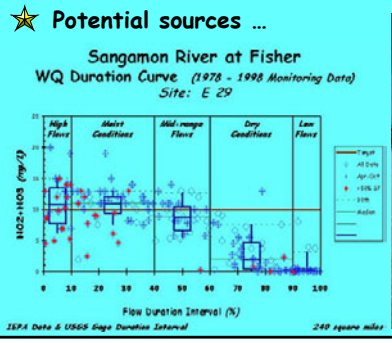
- Nitrates



Connecting the Pieces

Developing Solutions

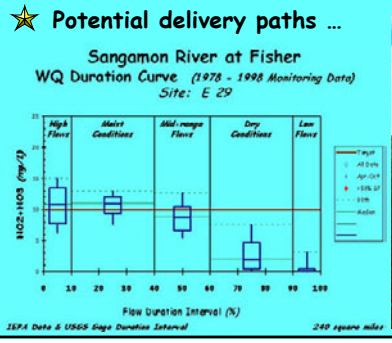
- Potential sources …



Connecting the Pieces

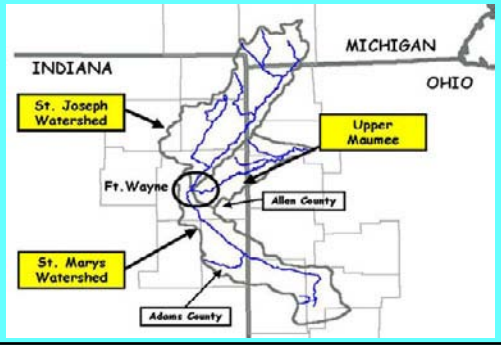
Developing Solutions

- Potential delivery paths …



St. Mary's / Upper Maumee

Watershed Plan Effort



Transition to Implementation

Utilize Existing Efforts

- St. Joseph River Watershed Initiative
  - *Bacterial Contamination*
  - *Nutrient Enrichment*
  - *Sedimentation*
  - *Pesticides*

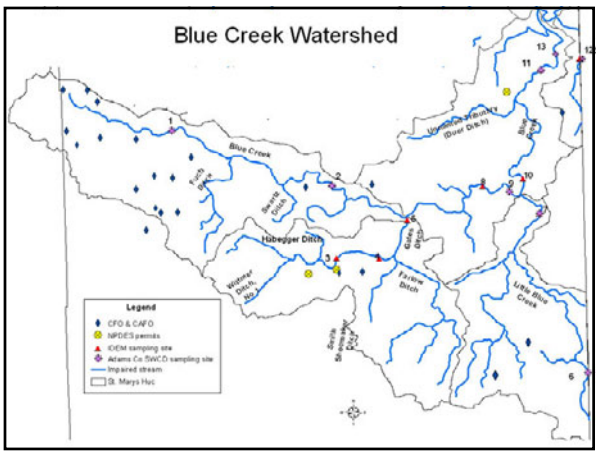
Utilize Existing Efforts

Long Term Goals

- Reduce loads:
  - *Sediment*
  - *Pathogens*
  - *Nutrients*
- Sub-watershed groups:
  - *Set individual targets*
  - *Address local concerns*

St. Mary's River -- Ohio SR 81, Wilshire, OH 3/25/2003

St. Mary's River -- Spy Run bridge at Fort Wayne 11/11/2004




Blue Creek -- SR 124 east of SR 101 7/23/2003

Upper Blue Creek 7/23/2003

Habegger Ditch -- near Berne 03/25/2003

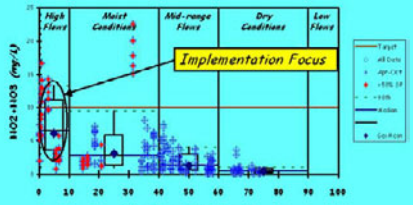
Yellow Creek 03/25/2003

Connecting the Pieces

Developing Solutions

- Nutrient Management -- *Nitrates*

St. Mary's Tributaries -- Aggregated Data
WQ Duration Curve *(2004 Monitoring Data)*

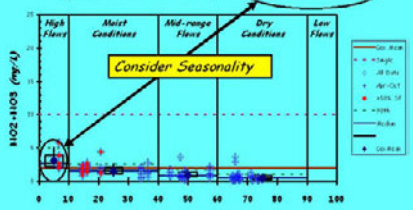


Connecting the Pieces

Developing Solutions

- Nutrient Management -- *Nitrates*

St. Mary's Tributaries -- Aggregated Data
WQ Duration Curve *(2004: August to October)*

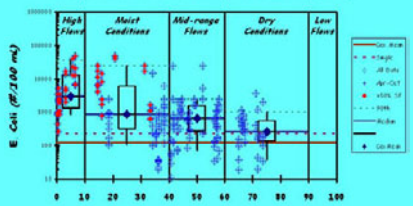


Connecting the Pieces

Developing Solutions

- Pathogen Reduction Efforts

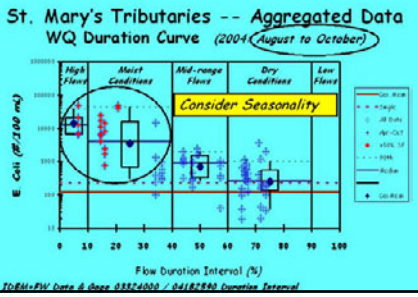
St. Mary's Tributaries -- Aggregated Data
WQ Duration Curve *(2004 Monitoring Data)*



Connecting the Pieces

Developing Solutions

- Pathogen Reduction Efforts



WHERE are the Sources

Connecting the Pieces

EXAMPLE	Duration Curve Zone				
Contributing Source Area	High	Moist	Mid-Range	Dry	Low
Point source				M	H
On-site wastewater systems	M	M-H	H	H	H
Riparian areas		H	H	M	
Stormwater: Impervious		H	H	H	
CSO's	H	H	H		
Stormwater: Upland	H	H	M		
Field drainage: Natural condition	H	M			
Field drainage: Tile system	H	H	M-H	L-M	
Bank erosion	H	M			

Note: *Potential relative importance of source area to contribute loads under given hydrologic condition (H: High; M: Medium; L: Low)*

Utilize Existing Efforts

Tools

- Public Education
- Conservation Programs
- Cost Assistance
- Monitoring & Analysis

Utilize Existing Efforts

Strategies

- **Pathogen & Nutrient Reduction**
  - *Manure management*
  - *Pasture management*
  - *Nutrient management*
  - *CSO / SSO correction*
  - *Home-site fertilizer education*
  - *On-site system repair / replacement*

Utilize Existing Efforts

Strategies

- **Sediment Reduction**
  - *Cover crops*
  - *Buffer strips*
  - *Conservation tillage*
  - *Stormwater management*
  - *Non-row crop alternatives*
  - *Construction site runoff*

Developing Solutions

Linking to Implementation Efforts

- **Focus:** *Source Areas & Delivery Mechanisms*
- **Example:** *SWMP Elements*
  - *Illicit Connections* (e.g. detection & elimination)
  - *Site Construction* (e.g. channel stabilization, bank protection)
  - *Post Development* (e.g. channel stabilization, bank protection)
  - *Pollution Prevention & Housekeeping*

Connecting the Pieces

Stormwater Management

- **Treatment Methods**
  - *Stormwater Ponds*
  - *Stormwater Wetlands*
  - *Infiltration Systems*
  - *Filtration Systems*

- **Alternatives** *(not all inclusive)*
  - *Stream Buffers*
  - *Disconnection Programs*

Connecting the Pieces

Developing Solutions

- **Focus:** ***Potential Management Practices***

EXAMPLE	Duration Curve Zone				
Source Area	High	Moist	Mid-Range	Dry	Low
Point source controls	L	L	M	H	H
Illicit Detection & Elimination	M	M-H	H	H	H
CSO repair / abatement	H	H	H		
SSO repair / abatement			M	H	H
Riparian buffers		H	H	H	
Construction site BMPs	H	H	M	M	
Pet waste education & ordinances		M	H	H	
Post development BMPs	H	H	M	M	
	Potential for effective load reductions under given hydrologic condition				

Connecting the Pieces

Developing Solutions

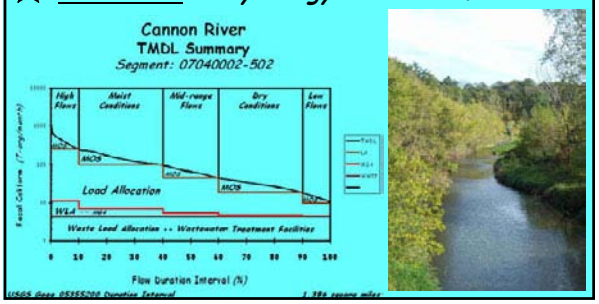
- **Components *plus* Implementation Considerations**

TMDL SUMMARY	Loads expressed as *(cfu/day)*				
	High	Moist	Mid-Range	Dry	Low
Reduction	92%	90%	79%	41%	0%
TMDL	1.39E+14	5.09E+13	2.37E+13	1.15E+13	5.09E+12
Load Allocations	9.32E+12	2.73E+12	2.26E+13	1.05E+13	4.22E+12
Wasteload Allocations	4.68E+11	4.68E+11	4.68E+11	4.68E+11	4.68E+11
CSO	1.25E+14	4.58E+13	0.00E+00	0.00E+00	0.00E+00
Margin of Safety	4.11E+12	1.89E+12	6.20E+11	4.99E+11	4.06E+11
Implementation	Long Term CSO Plan			Municipal NPDES	
Opportunities			Riparian Protection		
			Pet Waste Ordinance		
			Stormwater Mgt.		

Connecting the Pieces

TMDLs & Implementation

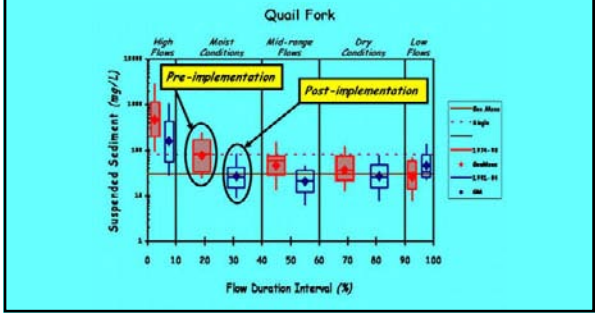
- **Alternative**: *Hydrology-based Framework*



Connecting the Pieces

Developing Solutions

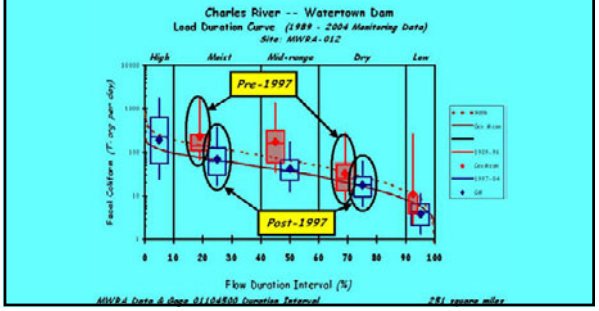
- **Erosion Control Actions**



Connecting the Pieces

Developing Solutions

- **Illicit Connection Detection & Elimination**



Connecting the Pieces

Developing Solutions

★ **Potential Actions** ***(i.e. SWMP Elements)***

Management Practice	Duration Curve Zone				
	High	Moist	Mid-Range	Dry	Low
Bacteria Source Reduction					
Remove Illicit Discharges					
Address Pet & Wildlife Waste					
Combined Sewer Overflow Management					
Combined Sewer Separation					
CSO Prevention Practices					
Septic System Management					
Managing Private Systems					
Replacing Failed Systems					
Installing Public Sewers					

Note: Potential relative importance of management practice effectiveness under given hydrologic condition *(H: High; M: Medium; L: Low)*

Connecting the Pieces

Developing Solutions

★ **Potential Actions** ***(i.e. SWMP Elements)***

Management Practice	Duration Curve Zone				
	High	Moist	Mid-Range	Dry	Low
Storm Water Infiltration / Retention					
Infiltration Basin					
Infiltration Trench					
Infiltration / Biofilter Swale					
Storm Water Detention					
Created Wetland					
Low Impact Development Practices					
Disconnecting Impervious Areas					
Bioretention					
Pervious Pavement					
Green Roof					
Rain Gardens					

Note: Potential relative importance of management practice effectiveness under given hydrologic condition *(H: High; M: Medium; L: Low)*

Connecting the Pieces

Developing Solutions

★ **Potential Actions** ***(i.e. SWMP Elements)***

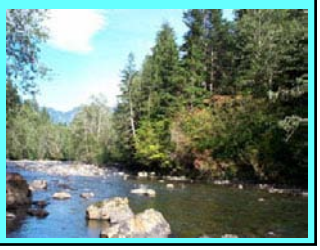
Management Practice	Duration Curve Zone				
	High	Moist	Mid-Range	Dry	Low
Agricultural Management Practices					
Managing Manure Application					
Pasture / Grazing Management					
Managing Barnyards					
Managing Recreational Sources					
Designate No Discharge Areas					
Address Discharges from Boats					

Note: Potential relative importance of management practice effectiveness under given hydrologic condition *(H: High; M: Medium; L: Low)*

Problem Solving Framework

Adaptive Management

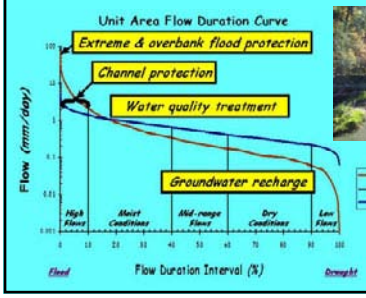
- Plan development using *"best available data"*
- Phased implementation with measurable milestones
- Iterative approach – evaluate results & enhance plan, as appropriate
- Focus – cumulative reductions in loading



Storm Water Management

Opportunities

- **Benchmarks**: *Connect to Program Objectives*



Storm Water Management

Opportunities

- **Benchmarks**: *Connect to Program Objectives*
- *Objective:* ***Measure Effectiveness of SWMP***
- *May be a range (recognize variability)*
- *Tool for guiding: Adaptive Management*

Storm Water Management
Getting to Solutions

Illicit Connections

- WQ Concern *(TMDL)*
  - *Bacteria, Nutrients*
- Condition *(Benchmark)*
  - *Dry, Low Flows*
- Solution *(BMP)*
  - *Detection & Elimination*

Storm Water Management
Getting to Solutions

Illicit Connections

- WQ Concern *(TMDL)*
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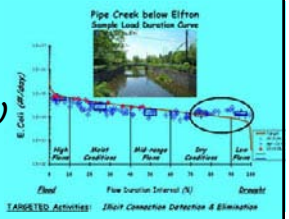


Storm Water Management
Getting to Solutions

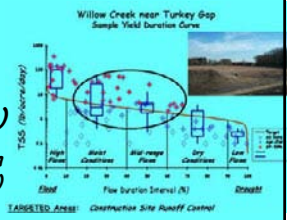
Site Construction

- WQ Concern *(TMDL)*
  - *Sediment*
- Condition *(Benchmark)*
  - *Mid-range, Moist, High (surface erosion events)*
- Solution *(BMP)*
  - *Silt fence, mulch, etc.*

Storm Water Management
Getting to Solutions

Site Construction

- **WQ Concern** ***(TMDL)***
  - ***Sediment***
- **Condition** ***(Benchmark)***
  - ***Mid-range, Moist, High (surface erosion events)***
- **Solution** ***(BMP)***
  - ***Silt fence, mulch, etc.***



Storm Water Management
Getting to Solutions

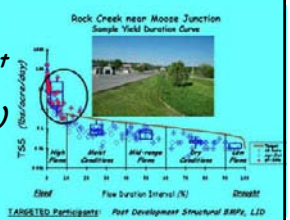
Post Development

- **WQ Concern** ***(TMDL)***
  - ***Aquatic Biota, Sediment***
- **Condition** ***(Benchmark)***
  - ***High Flows***
- **Solution** ***(BMP)***
  - ***Post Development BMPs, LID, etc.***

Storm Water Management
Getting to Solutions

Post Development

- **WQ Concern** ***(TMDL)***
  - ***Aquatic Biota, Sediment***
- **Condition** ***(Benchmark)***
  - ***High Flows***
- **Solution** ***(BMP)***
  - ***Post Development Structural BMPs, LID, etc.***



Storm Water Management

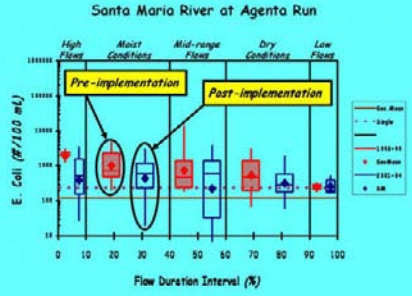
Opportunities

- **Monitoring & Storm Water Management Plans**
  - *Characterization*
  - *Benchmark development*
  - *Translating TMDLs & plans into actions with results*

Monitoring Focus

Build on Success

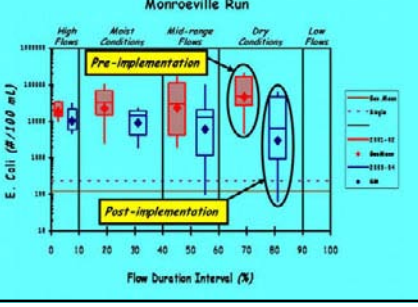
- **Documenting Results …** ***(CSO & stormwater control)***



Monitoring Focus

Build on Success

- **Documenting Results …** ***(septics & illegal connections)***

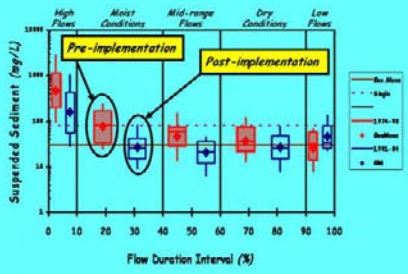


Monitoring Focus

Build on Success

- **Documenting Results** … *(erosion control program)*

Quail Fork



Problem Solving Framework

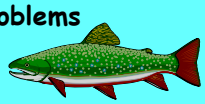
Public Involvement

- ✓ Fundamental to successful watershed plan development & implementation
- ✓ Challenge of explaining technical concepts & information in *"plain English"*
- ✓ Enormous effort, time, & resources to achieve meaningful participation
- ✓ Genuine commitment to listen, consider, & utilize citizen input

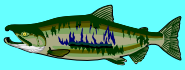
Transition to Implementation

Making It Work !!!

- **Target Problems**



- **Geographic Focus**

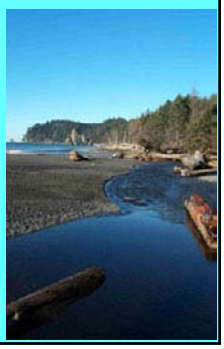


- **Environmental Results**

Transition to Implementation

Making It Work !!!

- Driving Principles
  - *Technically-based (logic path)*
  - *Meaningful (easily understood)*
  - *Value-added (connect with implementation efforts designed to solve problem)*



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